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(54) Title: SIGNALLING IN A TELECOMMUNICATIONS NETWORK

(57) Abstract

A method of transmitting calling user addressing information in a telecommunications network using Signalling System No.7. A call set-up phase is conducted between two exchanges of the telecommunication network to reserve a channel for user data. During this set-up phase, an Initial Address Message is transmitted from the first exchange to the second exchange, the Initial Address Message containing an Application Transfer Mechanism indicator to notify the second exchange that addressing information will be transmitted in one or more subsequent Application Transfer Mechanism Messages. The said one or more Application Transfer Mechanism Messages are then transmitted from the first node to the second node, each message including a Unidirectional flag to indicate that the message relates to the basic call context application and not peer-to-peer association context.

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Signalling in a Telecommunications Network

Field of the Invention

5   The present invention relates to signalling in a
telecommunications network and more particularly, though
not necessarily, to the transmission of information
relating to the address of a calling user or users over
the network.

10

Background to the Invention

Public telephone networks are increasingly making use of
a signalling protocol known as Signalling System No. 7
15   (SS7) to control the networks and to carry data
necessary for call set-up and control. Transmissions in
such networks, both user data and signalling, are
physically carried by a Time Division Multiple Access
(TDMA) transmission protocol operating in a given
20   frequency band. For example, in Europe the E.1
transmission protocol is used whilst in the USA the T.1
protocol is used (the main difference between these two
protocols being the number of time slots per TDMA
frame).

25

SS7 is usually referred to as a common channel
signalling system because signalling data packets are
carried on a common channel constructed from one time
slot per TDMA frame. A node of the network (e.g. a
30   transit exchange) determines whether or not a signalling
message is for it, or whether the message should be
forwarded to another node, on the basis of a destination
Point Code address conveyed with the message.

35   Figure 1 illustrates the functional architecture of an
SS7 network node. The lowermost layer of SS7 is the

Message Transfer Part (MTP) which provides the SS7
message segment for incorporation into the allocated
slot in the TDMA frame. The MTP is responsible for
reliably transferring messages on behalf of certain User
5   Parts across the SS7 network despite possible failures
in the network (e.g. using error checking, correction,
resending etc.).

The User Parts making use of the MTP include a Telephony
10 User Part (TUP), Signalling Connection Control Part
(SCCP), Transaction Capabilities Application Part
(TCAP), and ISDN Signalling User Part (ISUP). The TUP,
TCAP, and ISUP handle respectively signalling associated
with call unrelated service applications, an Integrated
15 Digital Services Network (ISDN) service application, and
a Plain Old Telephone Service (POTS) application. TUP,
SCCP, and TCAP are not of particular relevance here and
for further information the reader should refer to the
relevant standards(ITU-T Q.700 series of
20 recommendations). The following discussion is concerned
primarily with the ISUP.

The Integrated Digital Services Network (ISDN) is now
finding widespread use in the transmission of all types
25 of data (e.g. telephony, facsimile, telex) using a
common digital format. In its broadest implementation,
ISDN provides for the end-to-end transmission of digital
data in a common format, i.e. from a calling user's
telephone to a called user's telephone. In a narrower
30 sense, ISDN may provide for communication between
exchanges of a telecommunications network whilst, for
example, one or both of the calling and called user
communicate with their associated local exchange using
an analogue format.
35

One of the functions of the ISUP within the ISDN is to
assist in establishing an end-to-end connection between

the calling user's telephone and the called user's telephone. In particular, this involves reserving, during a call set-up phase, a user data channel between the local exchanges of the calling user and the called

5 user (if the exchanges are different). For this purpose, ISUP makes use of an Initial Address Message (IAM) capable of conveying 252 octets of data and which can be transmitted (via the MTP) in one of the E.1/T.1 TDMA slots allocated to the SS7 network (one IAM per

10 call). The information conveyed by the IAM consists of many different parameters and flags, including the calling user's number and possibly a forwarding/redirecting number. The structure of the IAM message is defined in ITU-T recommendation Q.763.

15

It is currently proposed to introduce new services into telecommunication networks such as number portability, Unidirectional personal telecommunication, intelligent network services and calling name identification

20 presentation. The existing calling user identity information (carried by the IAM) will not serve the purpose of the existing value added services or service applications (e.g. emergency services, malicious call identification) in addition to these proposed new

25 services (in particular because number portability will result in the loss of the geographic significance of a caller's number).

In order to support the proposed new services, it will

30 be necessary to enhance calling user addressing information transmitted in the call set-up phase of a call. The enhancement is distinguished by the separation of logical and physical addressing information of a calling user. For example:

35 1. The geographic location (i.e. latitude, longitude, and altitude) of the calling user;

2. The logical calling user ID (e.g. directory number, UPT number, IN service number);

3. The logical subscriber ID (i.e. the identity of the subscription owner who does not have to be the actual calling user (for example where the logical calling user is the identity of an employee and the logical subscriber ID is the company receiving the bill);

4. The physical calling user ID (i.e. an identity related to the physical/geographic connection of the calling user to the serving telecommunication network);

5. The calling user name (i.e. a text string corresponding to the name of the calling user; and

6. Additional calling user information (i.e. information received from the user).

The above identities may be transmitted from the caller's local exchange to the called user, or to some intermediate node. In the case of a call diversion, the identities referred to in items 1 to 5 will be repeated in a call, i.e. the actual calling user's ID and the new calling user's ID (i.e. originally called subscriber) in a forwarded call.

As the list of calling user information becomes more extensive, its sending by dedicated parameters within the IAM, in addition to the mandatory or essential call set-up data, may not be possible in all cases. An alternative approach is to send the data using the SCCP signalling capability which provides an end-to-end association. However, this presents an obstacle to the importation of other services (e.g. origin dependent routing) running at an intermediate node.

Under the existing ISUP specification, there is the possibility to send a "segmentation" message (SGM), following an IAM message providing that the SGM is

flagged in the IAM. The SGM is also 252 octets in
length and allows supplementary information to be
transmitted. Thus, it is possible to include additional
calling user addressing information in the SGM.
5   However, in many cases, the extra 252 octets may still
not be sufficient.

Summary of the Present Invention

10 It is an object of the present invention to overcome or
at least mitigate the above noted disadvantages of
existing SS7 based telecommunication networks. In
particular, it is an object of the present invention to
provide increased capacity for transmitting calling user
15 addressing information during a call set-up phase.

According to a first aspect of the present invention
there is provided a method of transmitting calling user
addressing information in a telecommunications network
20 using Signalling System No.7, the method comprising
conducting a call set-up phase between two nodes of the
telecommunication network to reserve a channel for user
data, the set-up phase comprising:
          transmitting an Initial Address Message from the
25 first node to a subsequent node, said Initial Address
Message containing an Application Transfer Mechanism
indicator to notify the subsequent node that addressing
information will be transmitted in one or more
subsequent Application Transfer Mechanism Messages; and
30   transmitting said one or more Application Transfer
Mechanism Messages from the first node to the subsequent
node.

Embodiments of the present invention enable a
35 substantially unlimited amount of addressing information
to be transmitted using Application Transfer Mechanism
Messages.

Preferably, said Initial Address Message contains a
limited amount of calling user addressing information,
for example the calling user's telephone number.

5

Preferably, the Initial Address Message and the
Application Transfer Mechanism Message(s) each contain
an Application Transport Parameter (APP) which carries
said addressing information. More preferably, each APP
10 contains a flag (e.g. a Unidirectional Indicator), the
purpose of which is to indicate to a receiving node
whether or not the APP pertains to a peer-to-peer
communication or to any application which may be present
at the receiving node.

15

Preferably, the calling user addressing information
transmitted in said one or more Application Transfer
Mechanism Messages includes at least one of: the calling
user's geographic location; the logical calling user ID;
20 the logical subscriber ID; the physical calling user ID;
the calling user name; and corresponding diverting user
identities.

Preferably, said Initial Address Message and said
25 Application Transfer Mechanism Message(s) are
transmitted over said telecommunication network in
respective single data packets, i.e. in respective Time
Division Multiple Access (TDMA) time slots. More
preferably, the last transmitted Application Transfer
30 Mechanism Message contains a flag set to indicate to the
receiving node that the message is the last Application
Transfer Mechanism Message.

According to a second aspect of the present invention
35 there is provided apparatus for transmitting calling
user addressing information in a telecommunications
network using Signalling System No.7, wherein a call

7

set-up phase is conducted between two nodes of the
telecommunication network to reserve a channel for user
data, the apparatus comprising:

first processing means provided at said first node
5   and arranged to generate an Initial Address Message and
to transmit this Message from the first node to the
subsequent node, said Initial Address Message containing
an Application Transfer Mechanism indicator to notify
the subsequent node that addressing information will be
10   transmitted in one or more subsequent Application
Transfer Mechanism Messages; and

second processing means arranged to generate said
one or more Application Transfer Mechanism Messages and
to transmit the Message(s) from the first node to the
15   subsequent node.

Preferably, said first and second processing means are
provided by a suitably programmed computer system.

20   According to a third aspect of the present invention
there is provided a method of transmitting information
in a telecommunications network, using Signalling System
No.7, during a call set-up phase between two nodes of
the network, the information being transmitted
25   unidirectionally from a first of the nodes to the
subsequent node and being intended for an application
present at the subsequent node, the method comprising:

transmitting an Initial Address Message from said
first node to the subsequent node, said Initial Address
30   Message containing an Application Transfer Mechanism
indicator to notify the subsequent node that said
information will be transmitted in one or more
subsequent Application Transfer Mechanism Messages; and

transmitting said one or more Application Transfer
35   Mechanism Messages from the first node to the subsequent
node,

8

the method further comprising including in the or
each Application Transfer Mechanism Message a flag for
indicating to a receiving node whether or not the
message is a unidirectional message.

5

Said subsequent node may be an intermediate node in the
transmission path of said information, the method
comprising relaying received Application Transfer
Mechanism Messages to a subsequent node in an unaltered
10   state when the messages contain a unidirectional flag
which is not set.

Brief Description of the Drawings

15

For a better understanding of the present invention and
in order to show how the same may be carried into effect
reference will now be made, by way of example, to the
accompanying drawings, in which:
20   Figure 1 illustrates functionally the architecture
of a conventional Signalling System No.7 node;
            Figure 2 illustrates functionally the architecture
a modified Signalling System No.7 network;
            Figure 3a is a flow chart illustrating the
25   reception of IAM and APM messages at a receiving
exchange of the system of Figure 2; and
            Figure 3b is a flow chart showing illustrating the
process of assembling message segments at a receiving
exchange of the system of Figure 2.
30
Detailed Description of Certain Embodiments

The shortcomings of the existing ISUP vis-à-vis
conveying calling user addressing information have been
35   described above. It is proposed here to overcome these
shortcomings by making use of a new transport mechanism
which has recently been defined for ISUP.

This new transport mechanism is known as the Application
Transport Mechanism (APM) and has been specified (draft
ITU recommendation Q.765) in order to enable ISUP to
5   provide the same capabilities as Transaction
Capabilities Application Part (TCAP). In particular,
APM enables ISUP to create a signalling data pipeline
between two network nodes for use by applications
running over the ISUP.
10

Consider for example the case where it is necessary to
send signalling data between two public telephone
exchanges (PBXs) which are outside of the SS7 network
(and to which the calling user 3 and called user 4 are
15   connected respectively). This situation is illustrated
in Figure 2, where the PBXs are indicated by reference
numerals 1,2 and are connected to respective exchanges
5,6 of the SS7 network. The signalling data requirement
of the PBXs is likely to exceed that which can be
20   provided by the IAM and SGM (i.e. any space in the IAM
and SGM which remains unoccupied after the necessary
ISDN call set-up flags and parameters have been
included) which are generated by the ISUPs 9,10.

25   The solution provided by APM is to create a pipeline via
which PBX interface applications 7,8, existing at the
two SS7 network exchanges 5,6 to which the PBXs 1,2 are
respectively connected, may communicate. When a call
connection is requested by the calling user 3 via the
30   associated PBX 1, the signalling data is passed by the
application 7 at the SS7 exchange 5 to the ISUP 9. An
IAM is then generated by the ISUP for transmission to
the remote SS7 exchange 6. However, the IAM includes an
additional indicator indicating that further APM
35   messages are to follow. This indicator, termed the "APM
segmentation indicator", is contained in an Application

Transport Parameter (APP) having the following multi-octet (1 to 4n) structure:

	8	7	6	5	4	3	2	1
1	Ext	Application Context Identifier						
2	Ext	UNI	SPARE				ATII	
							B	A
3	Ext	SI	APM segmentation indicator					
3a	Ext	SLR						
4a to 4n	Encapsulated Application Information							

5   The APP further contains an Application Context
    Identifier (ACI) which identifies the application for
    which the APP is intended. Thus, in the present
    example, the ACI identifies the APP as intended for the
    PBX interface application 8.

10
    The signalling data received from the application 7 is
    then segmented into a series of APP containing APMs,
    each with the appropriate segmentation and context
    indicators set. On the basis of these indicators, the
15 ISUP 10 at the receiving SS7 exchange 6 is able to
    reassemble the signalling information and pass it,
    otherwise unaltered, to the associated PBX interface
    application 8. It is noted that the IAM and the
    subsequent APMs are delivered to the receiving SS7
20 exchange 6 on the basis of the corresponding SS7 Point
    Code which is included in each of the messages. It is
    also noted that in this end-to-end (or peer-to-peer)
    transmission process the IAM and the APMs are not
    "opened" at any intermediate nodes present between the
25 two exchanges.

It is proposed here to make use of the APMs to transmit
additional calling user addressing information which
cannot be included in an IAM transmitted during a call
set-up phase. This extends the use of the APM beyond

5   merely providing a pipeline through the network (and the
ISUPs) for "external" applications.

Suppose that it is desired to convey a relatively large
amount of calling user addressing information from the

10   originating SS7 exchange 5 to the terminating SS7
exchange 6 during a call set-up phase, such that all of
this information cannot be included in the associated
single IAM (or more particularly the APP of the IAM).
Any overflow addressing information may be sent in

15   subsequent APP containing APMs. This however requires
the definition of a new identifier referred to here as
"UNI" which identifies the APP, to a receiving node, as
conveying (conventional) peer-to-peer data transfer
(identifier=0) or unidirectional data transfer

20   (identifier=1). This identifier may be allocated to an
appropriate spare identifier of the APP, e.g. bit 7 of
octet 2 as shown in the above table.

The UNI identifier allows intermediate nodes (e.g.

25   exchanges) to skip the segment reassembly process,
thereby saving time and processing in the call set up
phase. More particular, intermediate nodes will only
reassemble those segments belonging to APPs for which
the UNI identifier is set to 0, i.e. relating to peer-

30   to-peer data transfers. Where the UNI identifier is set
to 1, the APP is passed unaltered to the next node.

At the destination exchange, the basic call
establishment procedure first extracts the APP from

35   within the IAM or APM. It then checks to see if the UNI
identifier is set to 1. If so, then the procedure knows

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that the message is one of a sequence of messages
requiring recombination at the exchange. The APP
contains a specific Application Context Identifier
(octet 1) which identifies the application for which the
5   conveyed information is destined. In the present
example, this application will be an application which
makes use of the calling party addressing information.
This process is illustrated generally in Figure 3A.

10   Figure 3B illustrates in more detail the "Re-assembly of
segments" operation of Figure 3A. Note that only those
APPs having the same Segment Local Reference (SLR) are
combined together.

15   It will be appreciated that further modifications may be
made to the above described embodiment without departing
from the scope of the present invention. For example,
whilst the above example has been concerned with the
transmission of calling user addressing information, the
20   present invention may be applied to transmit other types
of information.

In certain circumstances, the transmitted information
(in this case user identity information) may be required
25   by a service application residing at an intermediate
node between the exchanges 5,6. This application may
be, for example, a billing application at a charging
node. This requires the assistance of the ISUP to
recollect the information present in the IAM.
30   Recollection is performed when the service application
sends an explicit request to the ISUP for APP triggering
pertaining to the transfer of user identity information.
Upon receiving two APP information elements within one
IAM, the ISUP at the intermediate node is unable to
35   distinguish the APP carrying the user identity
information from the other APP (carrying specific peer-

13

to-peer application data). To overcome this problem, the UNI flag is used by the ISUP to indicate whether the APP relates to peer-to-peer association context or whether it is part of the basic call context (and not

5 pertaining to any predefined application.

14

Claims

1.   A method of transmitting calling user addressing

5   information in a telecommunications network using
Signalling System No.7, the method comprising conducting
a call set-up phase between two nodes of the
telecommunication network to reserve a channel for user
data, the set-up phase comprising:

10   transmitting an Initial Address Message from said
first node to the subsequent node, said Initial Address
Message containing an Application Transfer Mechanism
indicator to notify the subsequent node that addressing
information will be transmitted in one or more

15   subsequent Application Transfer Mechanism Messages; and
        transmitting said one or more Application Transfer
Mechanism Messages from the first node to the subsequent
node.

20   2.   A method according to claim 1, wherein the Initial
Address Message and the Application Transfer Mechanism
Message(s) each contain an Application Transport
Parameter (APP) which carries said addressing
information.

25

3.   A method according to claim 2, wherein each APP
contains a Unidirectional Indicator flag to indicate to
a receiving node whether the APP is part of a peer-to-
peer transmission or whether the APP relates to a basic

30   call set-up context.

4.   A method according to any one of the preceding
claims, wherein said Initial Address Message contains a
limited amount of calling user addressing information.

35

5.   A method according to any one of the preceding
claims, wherein the calling user addressing information

transmitted in said one or more Application Transfer
Mechanism Messages includes at least one of: the calling
user's geographic location; the logical calling user ID;
the logical subscriber ID; the physical calling user ID;
5   and the calling user name.

6.   A method according to any one of the preceding
claims, wherein said Initial Address Message and said
Application Transfer Mechanism Message(s) are
10   transmitted over said telecommunication network in
respective single data packets.

7.   A method according to claim 6, wherein the last
transmitted Application Transfer Mechanism Message
15   contains an indicator set to indicate to the receiving
node that the message is the last Application Transfer
Mechanism Message.

8.   Apparatus for transmitting calling user addressing
20   information in a telecommunications network using
Signalling System No.7, wherein a call set-up phase is
conducted between two nodes of the telecommunication
network to reserve a channel for user data, the
apparatus comprising:
25   first processing means provided at said first node
and arranged to generate an Initial Address Message and
to transmit this Message from said first node to the
subsequent node, said Initial Address Message containing
an Application Transfer Mechanism indicator to notify
30   the second node that addressing information will be
transmitted in one or more subsequent Application
Transfer Mechanism Messages; and
         second processing means arranged to generate said
one or more Application Transfer Mechanism Messages and
35   to transmit the Message(s) from the first node to the
subsequent node.

9.   Apparatus according to claim 8, wherein said first
and second processing means are provided by a suitably
programmed computer system.

10.   A method of transmitting information in a
telecommunications network, using Signalling System
No.7, during a call set-up phase between two nodes of
the network, the information being transmitted
unidirectionally from a first of the nodes to the
subsequent node and being intended for an application
present at the subsequent node, the method comprising:
        transmitting an Initial Address Message from said
first node to the subsequent node, said Initial Address
Message containing an Application Transfer Mechanism
indicator to notify the subsequent node that said
information will be transmitted in one or more
subsequent Application Transfer Mechanism Messages; and
        transmitting said one or more Application Transfer
Mechanism Messages from the first node to the subsequent
node,
        the method further comprising including in the or
each Application Transfer Mechanism Message a flag for
indicating to a receiving node whether or not the
message is a unidirectional message.

11.   A method according to claim 10, wherein said
subsequent node is an intermediate node in the
transmission path of said information, the method
comprising relaying received Application Transfer
Mechanism Messages to a subsequent node in an unaltered
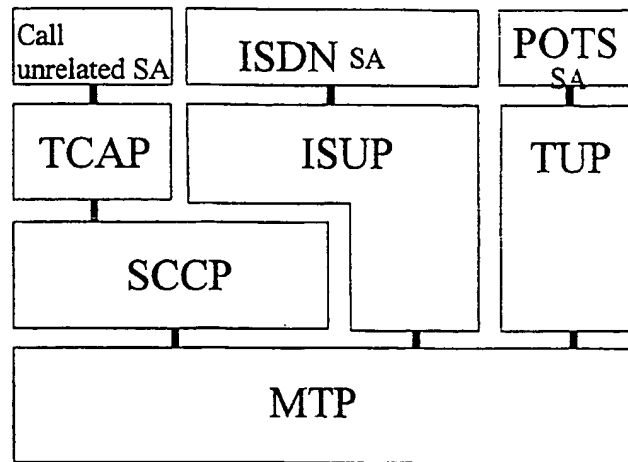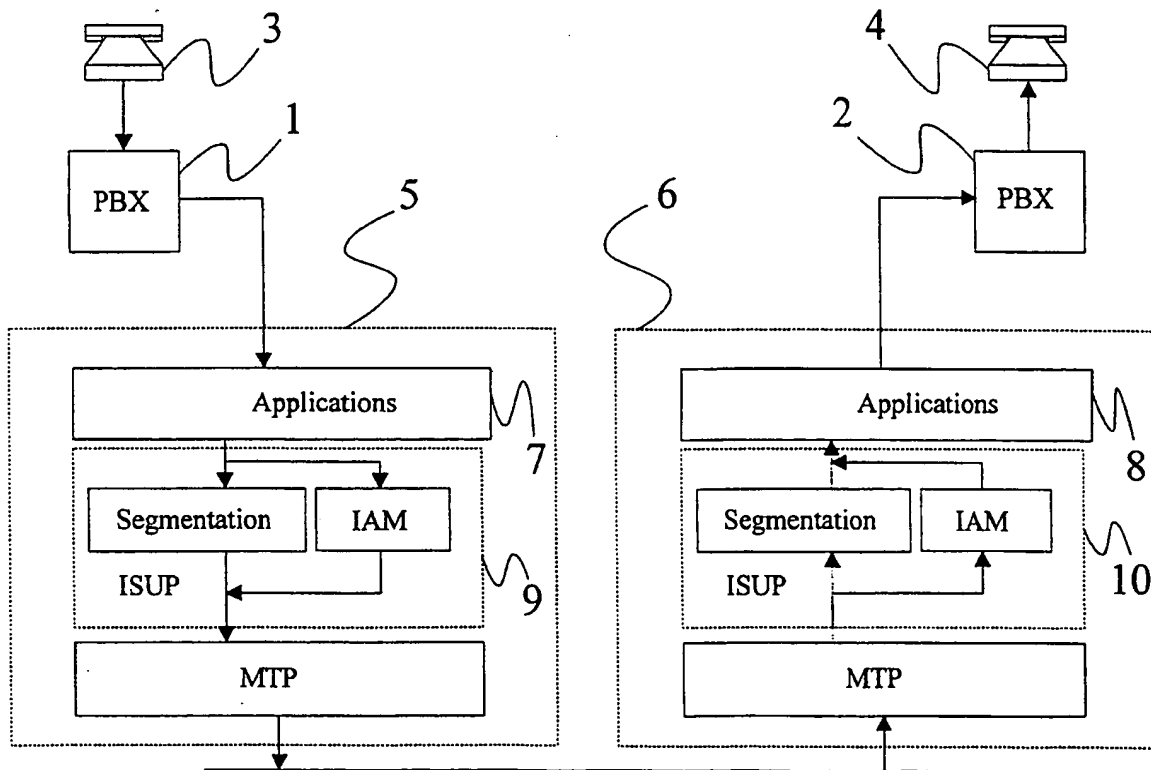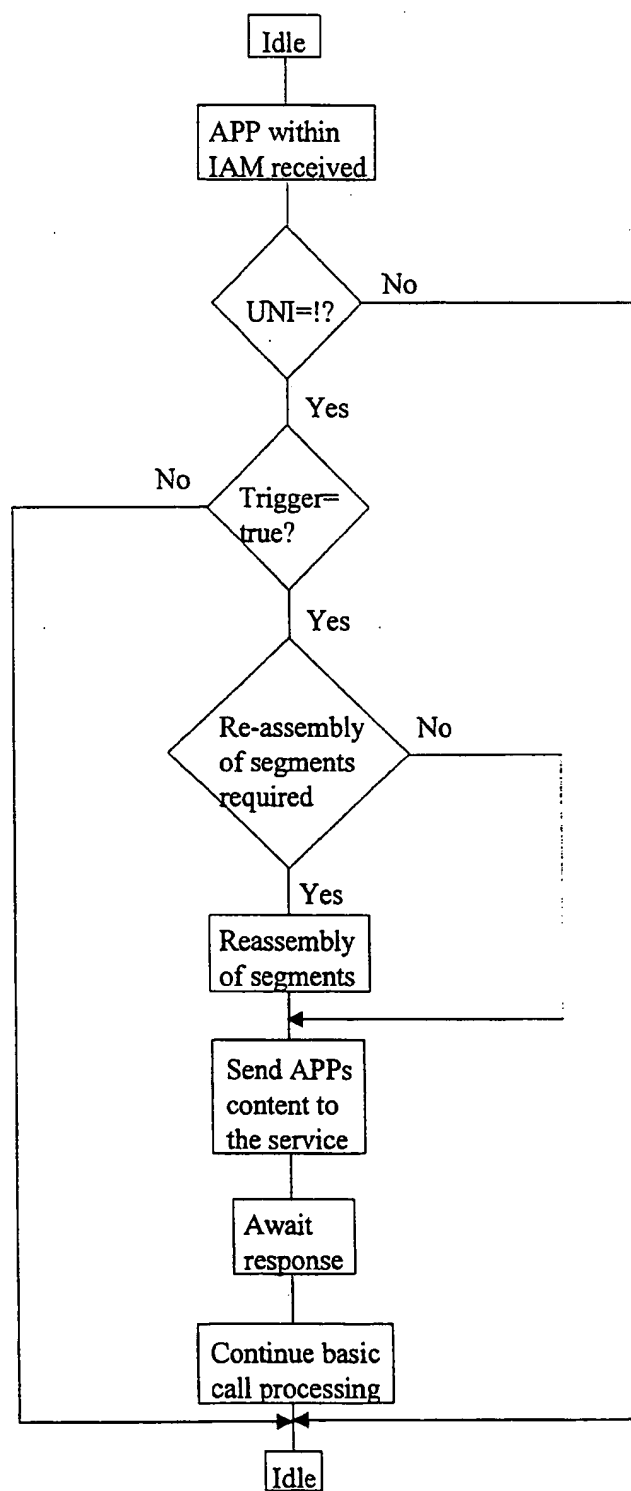state when the messages contain a unidirectional flag
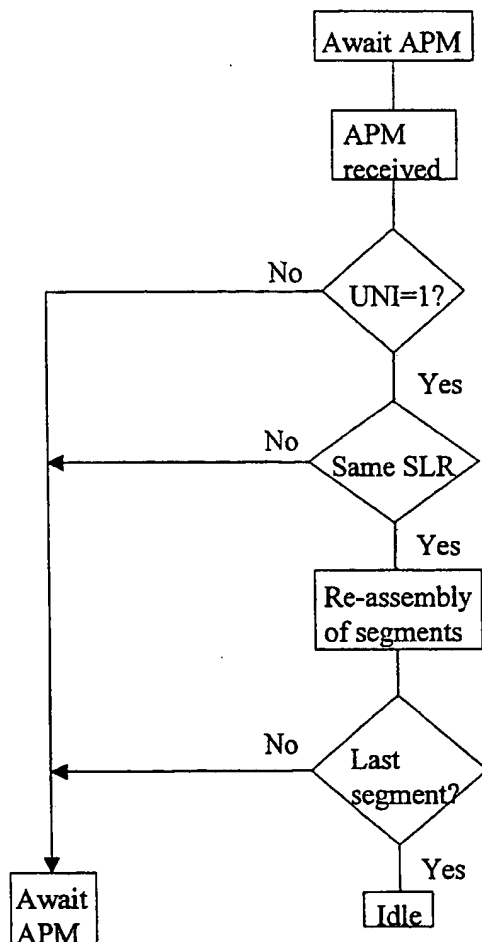which is not set.

Fig. 1

Fig. 2

```
                        ┌──────┐
                        │ Idle │
                        └──────┘
                            │
                    ┌───────────────┐
                    │  APP within   │
                    │ IAM received  │
                    └───────────────┘
                            │
                          ◇◇◇
                       ◇◇     ◇◇        No
                     ◇◇ UNI=!?  ◇◇ ──────────────────────────┐
                       ◇◇     ◇◇                             │
                          ◇◇◇                                │
                            │ Yes                            │
                          ◇◇◇                                │
              No       ◇◇     ◇◇                             │
        ┌────────────◇◇ Trigger= ◇◇                          │
        │              ◇◇ true?  ◇◇                          │
        │                ◇◇     ◇◇                           │
        │                   ◇◇◇                              │
        │                    │ Yes                           │
        │                  ◇◇◇◇◇                             │
        │               ◇◇        ◇◇                         │
        │             ◇◇ Re-assembly ◇◇     No               │
        │            ◇◇ of segments  ◇◇ ──────────┐          │
        │             ◇◇  required   ◇◇           │          │
        │               ◇◇        ◇◇              │          │
        │                  ◇◇◇◇◇                  │          │
        │                    │ Yes                │          │
        │            ┌───────────────┐            │          │
        │            │  Reassembly   │            │          │
        │            │  of segments  │            │          │
        │            └───────────────┘            │          │
        │                    │ ◄───────────────────          │
        │            ┌───────────────┐                       │
        │            │  Send APPs    │                       │
        │            │  content to   │                       │
        │            │  the service  │                       │
        │            └───────────────┘                       │
        │                    │                               │
        │            ┌───────────────┐                       │
        │            │    Await      │                       │
        │            │   response    │                       │
        │            └───────────────┘                       │
        │                    │                               │
        │            ┌───────────────┐                       │
        │            │ Continue basic│                       │
        │            │ call processing│                      │
        │            └───────────────┘                       │
        │                    │                               │
        └────────────────────┼───────────────────────────────┘
                          ┌──────┐
                          │ Idle │
                          └──────┘
```

Fig. 3A

Fig. 3B